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TMA CHEMICAL RELEASE PAYLOADS FOR
STRATOSPHERIC WIND MEASUREMENTS
AURORAL E PROGRAM AND RELATED
PROGRAMS

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report covers the work performed in support of the release of the methyl aluminum as a trail in the upper atmosphere via a sounding rocket. The payload was launched from Poker Flat Research Range of the University of Alaska Fairbanks, Alaska during March of 1981. The operation included design, fabrication, assembly and launch services of the chemical payload together with the refurbishment of several other chemical payloads.		

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I. SCOPE OF WORK

The purpose of this work was to provide a piston tank filled with trimethyl aluminum for release as a trail in the upper atmosphere. This payload was launched from the Poker Flat Research Range of the University of Alaska at Fairbanks, Alaska during the Auroral E Program in March of 1981. The smoke trail caused by the release was photographed and the data used in stratospheric wind measurements. The program also included the redesign and retrofit of several smoke trail payloads.

II. PAYLOAD DESCRIPTION

The payload consists of a programmer section with plumbing and a piston tank section. The outer shell of the payload is the wall of the piston tank. The liquid side of the piston tank is filled with 20 pounds of trimethyl- aluminum (TMA). After filling the liquid side, the gas side is pressurized to 100 psig nitrogen. Pyrotechnically activated valves controlled by the programmer allow release at the proper time in the flight. A schematic of the payload is shown in Figure 1.

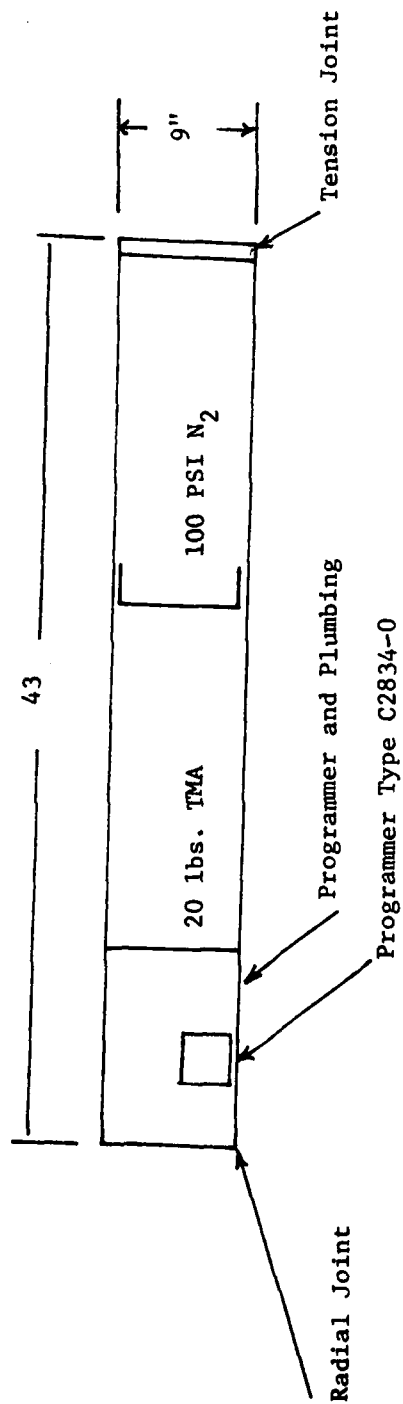
Some problems were encountered in the assembly of the piston tank payload. The cylinder was out of round and reboring was necessary. The greater bore diameter necessitated cutting new "O" ring grooves. At this time, it was also determined that the piston itself leaked. The leak was at the welded joint between the frontplate and the side wall. Rewelding the joint solved the problem. The payload proved to be pressure tight and operating properly.

Because a larger programmer was planned, it was necessary to have the programmer access door opening enlarged by approximately 40%. The larger door opening necessitated the construction of a new door as well as a larger and



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des
or



Payload Weight, 69.5 lbs.

Payload Chemical

Trimethyl Aluminum, 20 lbs.

Orifice Diameter, .093

FIGURE 1

AURORAL E - TMA

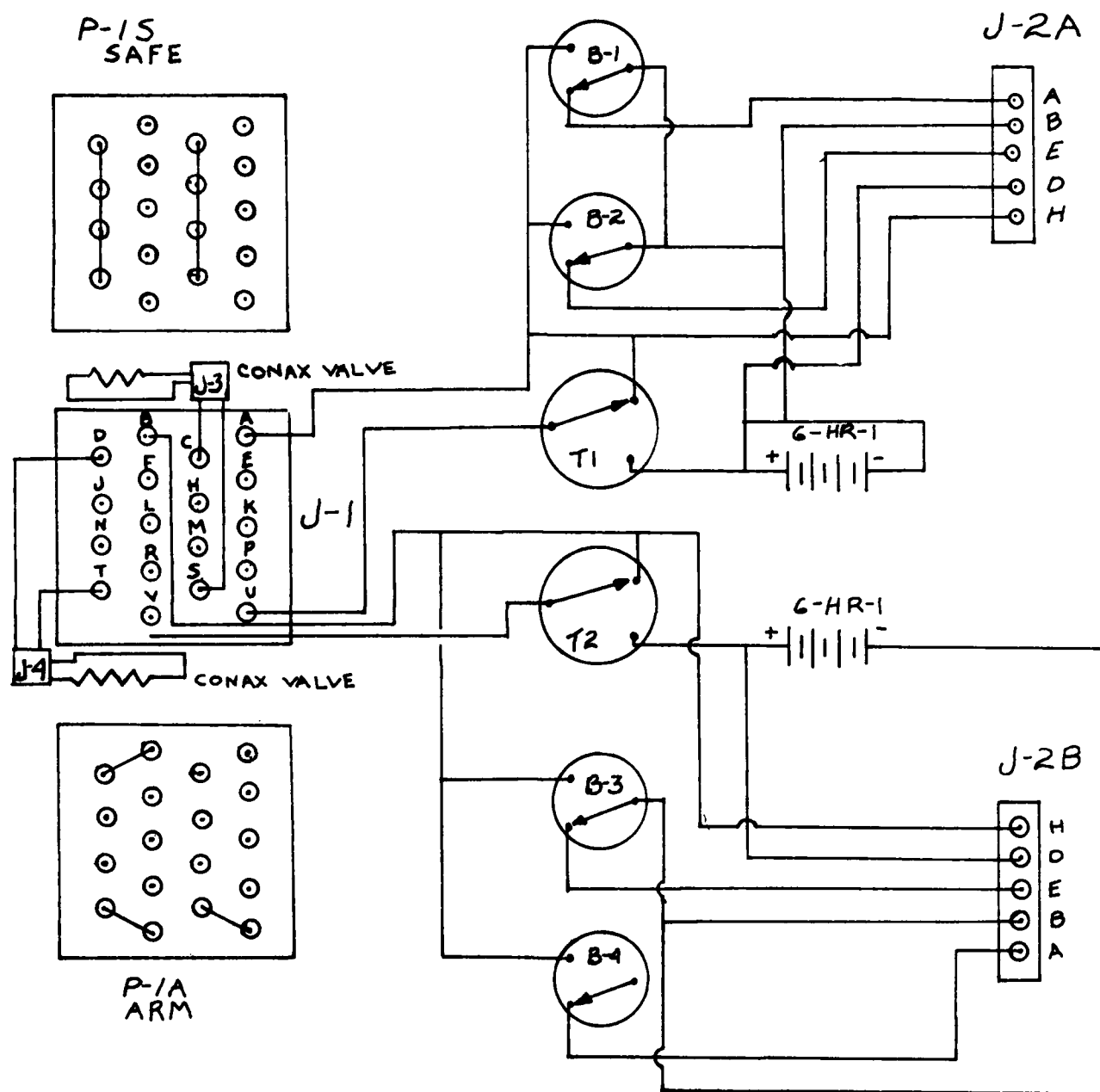
heavier door frame. This programmer was designed, developed and tested for use on the Auroral E TMA payload. Plans called for a 90 second trail release on the flight downleg. It was decided to design a redundant programmer and plumbing system. The payload originally contained one explosive valve. It was modified to contain two explosive valves in parallel. If one valve failed for any reason, the other would provide backup. The programmer circuit originally had one battery, one timer, and two barometric switches. The new design incorporated two of the above circuits and is shown in Figure 2. The design, as shown, was built and tested. The larger door provided adequate room to get to the timers and test plugs for pre-launch pad operations. A payload description document was written and forwarded to the interested personnel at AFGL and Poker Flat. It is included in this report. Final timer settings were made and the programmer checked again.

A shipment including the payload, hand tools, cold weather gear, protective clothing and face shields was made to AFGL, Hanscom Field, by truck. AFGL forwarded the shipment by Air Force plane to Poker Flat, Alaska. A payload description document was provided to AFGL for all launch activities.

III. FIELD TRIP

Franklin Research Center personnel arrived in Fairbanks, Alaska on February 17, 1981. The payload was checked and filled with TMA. During program makeup, the Yardley silver cell batteries failed to absorb electrolyte properly and showed voltage shorting to the case. A NiCad battery was obtained and integrated into the system. Voltage was checked every three days after charging and showed no deterioration.

The TMA payload was launched Friday, March 6, 1981 using a Paiute-Tomahawk vehicle at approximately 11:40 p.m. local time from Poker Flat Research Range,



B - Barometric Switch
 T - Timer
 HR-1 - Silver Cell Batteries

FIGURE 2

Alaska. Operation was proper. TMA released at 266 seconds after launch with a visible trail that persisted for several minutes.

IV. PROGRAM RESULTS

A. Battery Developments

A new battery pack was designed. This was necessary because the supply of Yardley silver cell batteries is depleted and new silver cell batteries are very expensive due to fluctuations in the precious metals market.

A survey of available batteries indicated that a NiCAD type was available from General Electric Company. The GE #123233 (K01A111AA-SD1) delivered 12.0 volts at 450 milliamp hour. The recharge rate is 45 milliamp hours for 16 to 18 hours. The battery measured 2-1/16" high x 1 1/4" wide by 2-15/16" long. Several of these batteries were acquired and tested successfully. The two batteries tested delivered 13 amps at 6 volts through a 0.5 ohm resistor for a period of two seconds. Battery packs were ordered and integrated into the existing programmer systems. The programmer and programmer bracket were re-designed to accommodate these batteries.

B. Payload Re-design and Retrofit

Two payloads designed as trimethyl-aluminum smoke trail payloads were checked for piston problems. The pistons are of the welded type (flat plate welded to short cylindrical section). It will be necessary to rework and remachine these pieces as the leaks are through the welded interface of the piston.

A titanium-tetrachloride/water-methanol payload (12") has been redesigned. The payload tankage consists of two aluminum tanks with pistons, and was redesigned as two single tank trimethyl-aluminum payloads. The design work involved the redesign of the programmer sections, plumbing, adaptor joint and

nose cone.

C. 11th Symposium on Explosives & Pyrotechnics

Mssrs. Stokes, Murphy and Kershner of the Franklin Research Laboratories attended the 11th Symposium on Explosives and Pyrotechnics in Philadelphia, Pennsylvania, September 15 through 17, 1981. Several papers covered the chemistry and physics of explosively activated devices as well as statistical methods outlining advanced Bruceton tests. Of particular interest were papers on the non-destructive testing of bridge wires in electro-explosive devices.